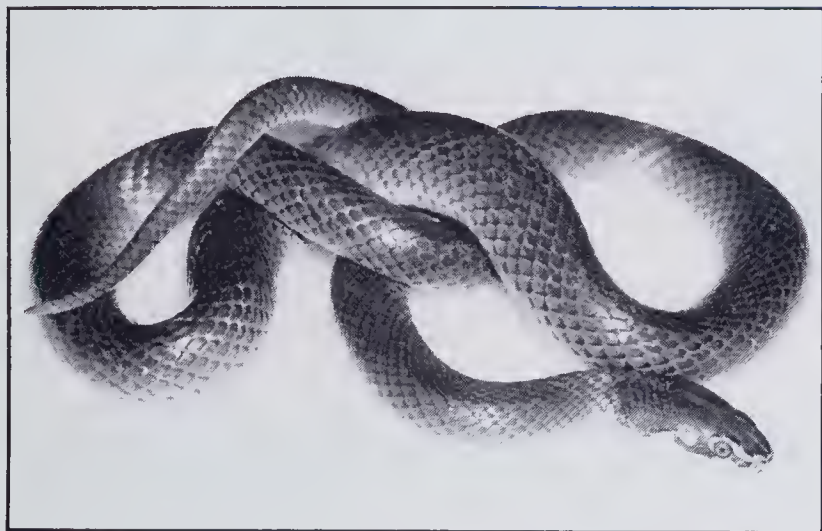

NORTHERN TERRITORY

NATURALIST



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Contributions to the N.T. Naturalist need not be members of the N.T.F.N.C., although all members are urged to contribute. Contributions may take one of the following forms:

Letter to the Editor

A letter should be a short comment on a previous publication in the N.T. NATURALIST, a comment on an issue of topical interest in natural history, or a brief report of a field trip. Letters may be handwritten provided they are well presented. Only one copy of a letter is required.

Notes

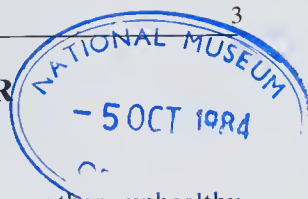
If you have made a series of observations (for example, on the behaviour of a bird or other animal) or have notes on something new or unusual in the field, then this is the place to report your findings. Contributions should be in the order of 200-500 words and provided with a title.

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An article should run to a maximum of about 1500 words (four to five double-spaced typed, A4 pages) and deal with a topic in the sciences. It should be written in a manner intelligible to readers without a specialist knowledge of the subject. Articles should be appropriately illustrated by clear, black ink graphs, diagrams or photographs.

Cover: Curl Snake *Denisonia suta*

LETTER TO THE EDITOR



Dear Sir,

Sewage treatment tanks, words that conjure up rather unhealthy preconceptions in the minds of most people, are often exceptionally happy hunting-grounds for bird-watchers.

Wading-birds that nest in remote areas of the Northern Hemisphere during the spring months (March to May) make long migrations southwards. Many species arrive in Australia, either on purpose, or sometimes because inclement weather makes them overshoot their intended destination.

This latter category seems to have an uncanny knack of finding refuge at nice, peaceful sewage tanks, often metamorphosing into giant 'ticks' (ticks = a new bird for the list) for lucky members of the birding fraternity!

Alice Springs sewage tanks provide an interesting freshwater habitat, just a few kilometres south of the town centre. On 12 November 1983 I had just started around the perimeter of the tanks when I saw what looked like a tiny gull, floating very bouyantly on the water. Through the binoculars the bird's needle-like bill became visible, deftly picking at the surface while the bird delicately pirouetted about.

This bird had to be a species of the family Phalaropodidae. These birds typically feed while swimming, propelled by lobed-toes. Dense feather-masses on the belly account for the pronounced bouyancy, and the birds' gyrations are to create a turbulence which brings their invertebrate food closer to the surface.

They breed mostly in the Arctic circle, the larger females instigating courtship and defending the nest against other females while the males incubate the eggs and then care for the young.

This individual had grey upperparts and pale underparts. The top of the crown and back of the long neck was dark, and a blackish ear-streak was present on an otherwise pale head. The eye was dark, and the straight bill was totally black, about the same length as the head. When the bird flew a pale bar was seen clearly along the margins of the upper wing coverts; the tail was a dark colour. During the flight the call was uttered, which I wrote down as 'tsic'.

This, then, was a red-necked phalarope, *Phalaropus lobatus*, an unusual bird to see on the coastline of Australia, let alone in such an inland place many hundreds of kilometres from the sea.

I did not see this red-necked phalarope ever touch land; it was always milling about on the water in close proximity to a flock of red-necked Avocets, *Recurvirostra novaehollandiae*, and even flew with these considerably larger waders.

(Unbeknown to me then, Mike Fleming of the Conservation Commission had seen this individual a few days before Ian Archibald and myself. The bird left the area shortly after our visit.)

David Percival
Museum and Art Galleries of the Northern Territory

NOTES ON THE SCINCID LIZARD *Cryptoblepharus litoralis* (Mertens, 1958) IN THE NORTHERN TERRITORY

Paul G. Horner
Division of Natural Sciences
Museum and Art Galleries of the Northern Territory

Cryptoblepharus litoralis was first recorded in the N.T. by Gow, 1981. This record was based on two specimens collected by the present author and G. Gow, from Cape Wessel Island (11°00'S 136°46'E, October 1979). Subsequent field work along the Arnhem Land coast by the author, has shown that the species is present on both New Year Island (10°55'S 133°02'E) and Oxley Island (10°59'S 132°50'E). These records extend the species distribution westwards, almost to Croker Island (figure 1). The skink was previously known only from the coastal fringes of northeastern Queensland, Torres Strait Islands and New Guinea.

The genus *Cryptoblepharus* is composed of active, diurnal lizards which are normally arboreal or saxicoline in habit. The lower eyelid is fused to the upper, leaving the eye covered by a transparent disc. This character gives the genus its vernacular name of 'Snake-eyed skinks'. *Cryptoblepharus litoralis* is a large, dark coloured species, which is known from a variety of habitats in the supralittoral (foreshore) zone. Of the eight N.T. specimens collected, only the specimen from New Year Island was found amongst beach debris. Other specimens were active on or around rock outcrops, close to the water's edge.

Observations on the behaviour of *C. litoralis* from Oxley Island provided interesting results. They are agile, fast moving animals which, in a suitable habitat, tend to congregate in small groups. Several specimens were observed foraging amongst rocks in the intertidal zone, one of which, upon collection, disgorged a polychaete worm of the family *Nereidae*. Cogger (1983) lists their usual diet as amphipods and other small marine animals. When confronted by an incoming tide the lizards retreated to the fringing vegetation. However, a few specimens were observed on rocks completely surrounded by water. When cornered these animals leaped into the sea and rapidly swam to the shore or another rock. I consider this to be atypical behaviour, as it would possibly leave them susceptible to predation by fishes.

The N.T. specimens showed little variation in morphological characters when compared to a similar sized sample from northeastern Queensland (table 1).

There are slight differences between the two populations, specifically in the mid body scale count and the number of lamellae under the fourth toe. These two characters were compared for similarities or differences between the two populations, using a Mann Whitney U-test. The results indicate that there are significant differences between N.T. and Qld. specimens.

Cryptoblepharus litoralis is generally characterised by its foreshore dwelling habits, but other species of *Cryptoblepharus* also may be found in close proximity to the shore. Table 2 lists some of the taxonomic characters which may be used to differentiate N.T. species of *Cryptoblepharus*.

Material examined:

N.T. Museum: R7761-62 Cape Wessel I.; R10905 New Year I.; R10923-27 Oxley I.

Qld Museum: J20434-35 Lizard I.; J25448-49 Johnstone River; J27680 Magnetic I.; J32562-63 Townsville; J32565 Magnetic I.

Acknowledgements

My thanks go to Ms J. Covacevich, Curator of Reptiles at the Queensland Museum, for the loan of specimens in her care. Special thanks go to Mr J.N.A. Hooper who critically read the final draft.

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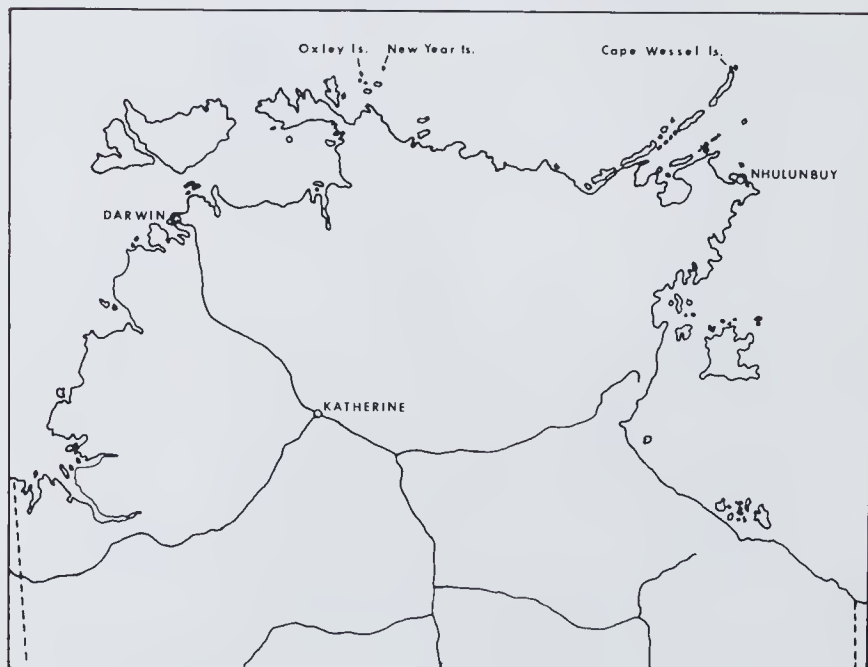
**Table 1: COMPARISON OF BODY PROPORTIONS
AND SCALE COUNTS OF *Cryptoblepharus litoralis* IN THE N.T. AND QLD.**

Feature	N.T. n=8	Qld. n=8
hindlimb length, % SVL	38.6–52.6 mean = 44.1	41.5–46.7 mean = 43.8
axilla to groin length, % SVL	43.5–54.9 mean = 50.3	48.3–57.6 mean = 53.0
forelimb to snout length, % SVL	35.3–45.1 mean = 39.3	35.6–40.0 mean = 37.8
mid body scale rows	27–30 mean = 28.1	26–27 mean = 26.3
paravertebral scale rows	49–56 mean = 51.9	49–55 mean = 51.6
no. of lamellae under 4th toe	17–19 mean = 18.1	19–24 mean = 20.6

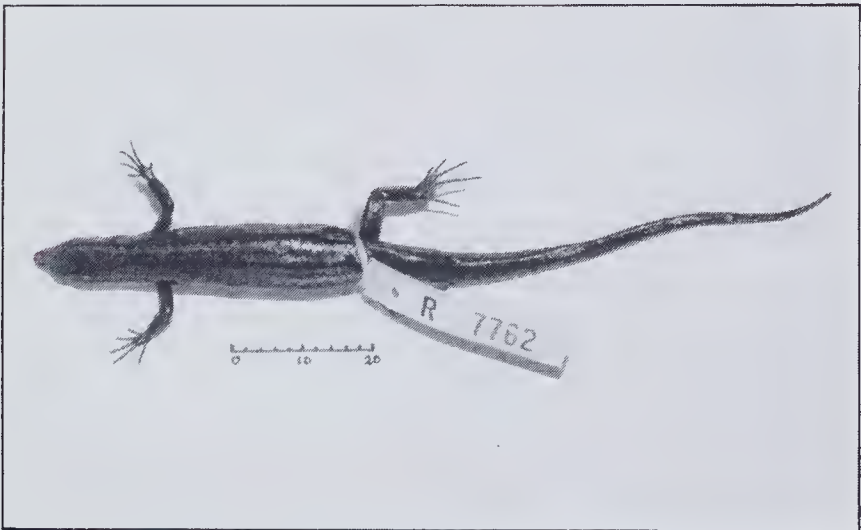
**Table 2: COMPARISON OF SOME MORPHOLOGICAL CHARACTERS
OF N.T. MEMBERS OF THE GENUS *Cryptoblepharus***

species	subdigital lamellae	lower surfaces of hands & feet	number of supraciliary scales	max. snout/ vent. length
<i>carnabyi</i>	finely keeled	whitish	5	40 mm
<i>litoralis</i>	smooth	black	5	55 mm
<i>megastictus</i>	smooth	whitish	6, rarely 5	40 mm
<i>plagiocephalus</i>	smooth	light brown/ whitish	6, rarely 5	47 mm

**FIGURE 1: MAP SHOWING THE N.T. ISLANDS WHERE
Cryptoblepharus litoralis HAS BEEN RECORDED**



Figures 3 and 4: *Cryptoblepharus litoralis* — N.T.M. R7762, from Cape Wessel Island, N.T. Scale in mm.



FIRST SIGHTING OF THE SPOTTED REDSHANK *Tringa erythropus* IN AUSTRALIA

John L. McKean and Alan R. Dampney

Introduction

Larger than usual numbers of waders visited the Darwin area during the 1983/84 summer. Exceptional numbers were recorded for the less common species such as Oriental Plover *Charadrius veredus*, Long-toed Stint *Calidris subminuta*, and Wood Sandpiper *Tringa glareola*. Varieties observed included Ruff *Philomachus pugnax*, Little Ringed Plover *Charadrius dubius*, Little Stint *Calidris minuta*, Pectoral Sandpipers *Calidris melanotos*, Pin-tailed Snipe *Gallinago stenura*, Redshanks *Tringa totanus*, the first record for Northern Territory of Bairds Sandpiper *Calidris bairdii* (McKean, in press 1984), and the first reported sighting of the Spotted Redshank *Tringa erythropus* in Australia, which is the subject of this note.

The Spotted Redshank breeds in the northern Palearctic from Scandinavia to far eastern U.S.S.R., migrating south to 'winter' in Africa. South and Southeast Asia to the Malay Peninsula (Medway and Wells, 1976). It occasionally occurs further east, (e.g. at least thirteen sight records from Borneo; Smythies, 1981) and recently (August 1983) a single bird was seen on Halmahera, Moluccas (Peter Kaestner, pers. comm.). It is, perhaps, surprising that this species has not previously been recorded in Australia.

Field Notes

On 16 November 1983, at 0615 hours we were watching waders at Darwin, N.T. McKean's attention was drawn to a wader flying in from the sea uttering a whistled 'chu-eet, chu-eet'. Although McKean had heard Spotted Redshanks previously in Hong Kong he could not immediately identify the call but knew that it was not that of a wader normally found in the Northern Territory. In flight the bird appeared about the size of a Greenshank *Tringa nebularia* with a similar white rump patch extending in a wedge up the back. The upper surface of the wings were plain except for some lighter mottled areas on the wing coverts and the bird lacked any indication of a wing stripe.

The bird landed in front of us, but with the sun directly behind it viewing conditions, despite the use of a 20X telescope, were not optimal. The following identification points were noted. The bill was long, straight and dark but paler at the base. It was proportionally longer than that of a Redshank. The legs were also longer than those of a Redshank but the poor light prevented us from being sure of their true colour. We thought they could have been blackish red. A noticeable white superciliary stripe was present, throat white; well marked brown grey pectoral gorget; belly and rump white; tail end dark, and dorsal plumage brown grey exactly the shade of the bird in figure 3 of plate 50 in Cramp *et al.* (1983). When the bird lifted its wing the underwing coverts were seen to be whitish.

The bird appeared very nervous and vanished while we were clambering down the rocky cliff for a closer view. At 1530 hours on the same day McKean revisited the area and heard the bird call from behind some rocks. He did not disturb the bird as other observers had been notified and he hoped they would see it later on. The bird

was seen again by McKean, briefly between rain squalls at 0715 hours the following day and the legs were noted to be orange and the dark end of the tail was seen to actually consist of barring. The Spotted Redshank has not been seen subsequently.

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STREAKED SHEARWATER *Calonectris leucomelas* IN THE NORTHERN TERRITORY

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Carter (1983) has drawn attention to the regular occurrence of this species in Northern Australian waters. Observations made on 17 February 1984 from T.S.M.V. Febrina, which was cruising between Darwin and Gove, (10° 53' .49s, 133° 39' .89e) additionally confirm this. The conditions were cloudy, with slight drizzle, and wave-height was about 1.5 metres.

At 16.40 a single Streaked Shearwater was seen flying past the vessel. Single birds and groups of three or four were seen regularly after this, until 17.15 hours, when a large group of birds was seen. A small cloud of fifty Sooty terns *Sterna fuscata* were working fifteen to twenty metres over a large 'raft' of about one hundred and fifty Streaked Shearwaters. They were settled on the ocean surface, which was erupting with tuna of about 0.5 kilo. As the tuna moved off to another area, the whole mass of birds would fly over to where the fish reappeared.

The only other Procellariidae seen with the Streaked Shearwaters were a Tahiti Petrel *Pterodroma rostrata* and a heavy, all dark-brown bird, of a similar size to *Calonectris leucomelas*, which I could not identify. M. Carter (in litt. to J.L. McKean, Mss. in prep.) has a number of unpublished sightings of *P. rostrata* off the N.T.

The tuna were identified by Helen Larson (N.T. Museum), also on the boat, as being probably Northern Bluefin *Thunnus tonggol*. These typically school and drive their food (fish and squid) to the surface.

Reference

CARTER, M. 'Streaked Shearwaters in Northern Australia', Australian Birdwatcher 10(4):113-121.

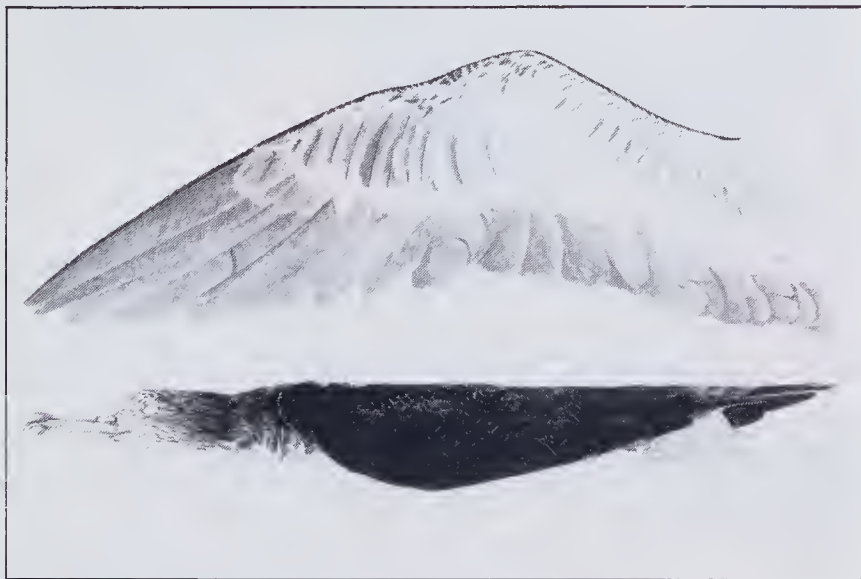


Figure 1: Streaked Shearwater — underwing and side-view. The painting was taken from a study-skin at the N.T. Museum. The dead bird was presented to the museum anonymously. Any information about the location of collection and date would be appreciated.

THE CURL SNAKE *Denisonia suta* (Peters) A DANGEROUS ELAPID IN THE NORTHERN TERRITORY

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Summary

The Curl snake *Denisonia suta* (Fig. 1) has previously been disregarded as a species potentially dangerous to man. A venom toxicity study undertaken on Northern Territory specimens reveals a subcutaneous LD₅₀ of 20.68 μ .g. in 20 gram mice. Variation is evident in the total lengths of adult snakes collected from three geographically isolated populations and this feature is correlated with venom yields of adult specimens representing two of these populations (Fig. 3). Some aspects of *D. suta* natural history in the Northern Territory are considered in the assessment of its threat to man in this state.

Introduction

Throughout its distribution *Denisonia suta* is entirely nocturnal in habit and shelters during the day beneath rocks and debris or in deep ground crevices.

Probably because of its small size, *D. suta* has not been regarded as dangerous to man. Most authors agree that it is capable of inflicting an extremely painful bite or that care should be taken with large specimens (Kingham, 1964, P. 176; Kellaway, 1934; Worrell, 1966, P. 146; Cogger, 1979, P. 404; Gow, 1976, P. 65; McPhee, 1979, P. 70) however it has also been inferred to be an innocuous species (Houston, 1973).

In November 1979 a domestic cat sustained a fatal bite while eating a juvenile *D. suta* in a residential area of Alice Springs. Details of this case are presented below. Following this incident a study was initiated to assess the potential of *D. suta* as a snake dangerous to humans.

In this assessment we have examined snake length, venom yield and venom toxicity combined with relevant information on the distribution, behaviour and ecology of the species.

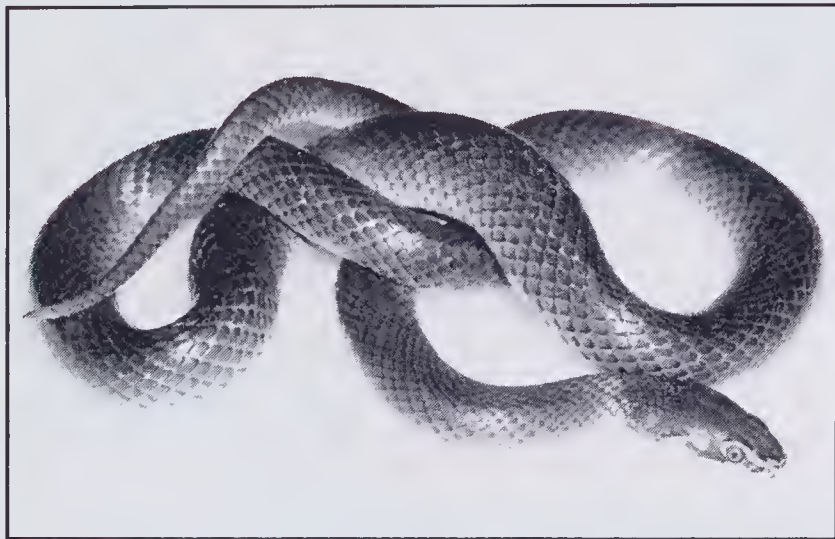


Fig 1: Typical adult from Alice Springs district.

Methods

To determine venom yields, captive specimens were deprived of food for a week prior to venom extraction. During early trials it was discovered that captive snakes readily expelled venom for about the first 20 seconds they were handled but any prolonged attempt to individually 'milk' both glands usually resulted in a poor yield from the second fang. To overcome this bias a pipette was used to milk venom from the right side fang only and this venom weight was then doubled to provide the total yield.

The LD₅₀ determination was calculated using the Spearman-Kärber method (Finney,⁵⁰ 1964) with venom obtained from snakes collected from the Barkly Tableland and Alice Springs districts. Fresh and freeze-dried, reconstituted venom was used.

Eighteen to twenty one gram laboratory white mice were injected subcutaneously in the flank with a 0.2 ml saline solution of a range of dilutions of fresh venom. The range of doses given was from 8 μ .g. to 30 μ .g. in a dose interval of 1:1¼. Deaths were recorded over a 48 hour period.

Results

Distribution and Habitat: In the Northern Territory this species is represented by three geographically isolated populations (Fig. 2). Throughout the central Alice Springs district it inhabits rocky ranges and adjacent riverine and woodland areas. In the Barkly Tableland district, it occurs throughout the 'black soil' tussock grass plains. The two Victoria River district specimens were collected from an alluvial flood plain with grass tussocks and cracking soil.

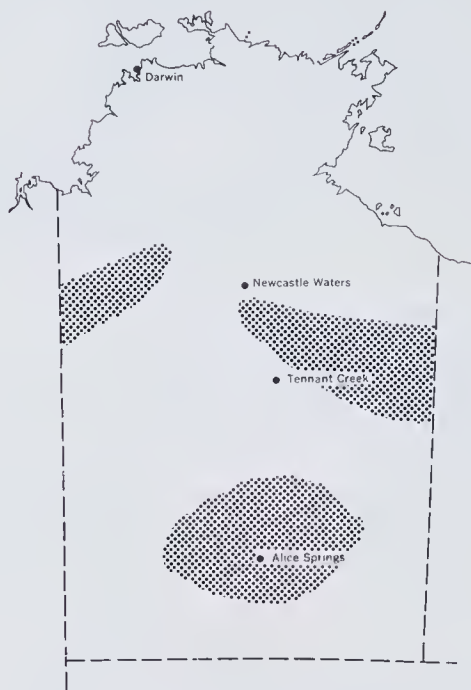


Fig. 2: Distribution of *Denisonia suta* in the Northern Territory.

Geographic Variation in Snake Lengths: Twelve specimens collected from the Alice Springs district ranged from 31-56 cm in total lengths with a mean of 43.5 (s.d. = 8.3). Twelve specimens collected from the Barkly Tableland district ranged from 57-75 cm in total lengths with a mean of 70.3 (s.d. = 5.4). Only two specimens, measuring 52 and 54 cm in total lengths, have been collected from the Victoria River district. The tails of all snakes measured, were complete.

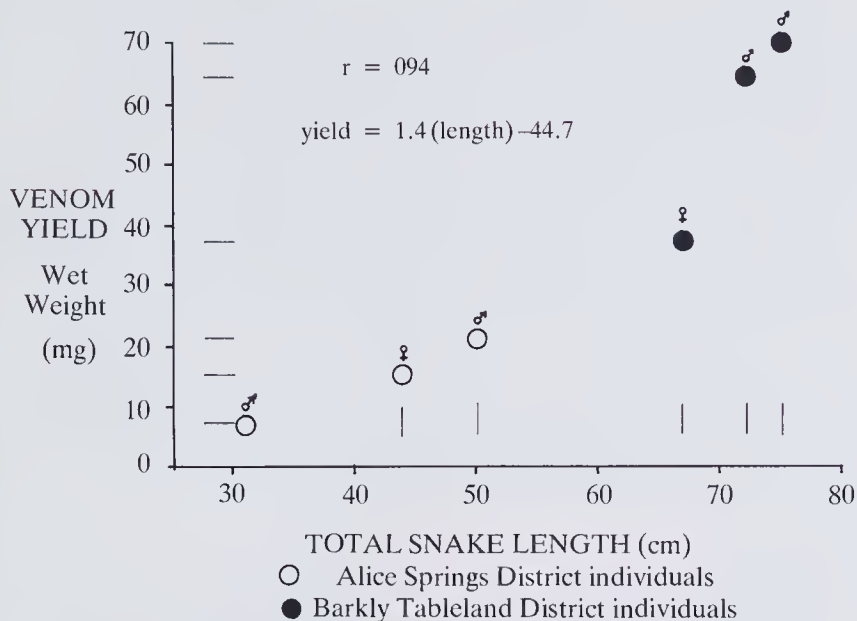


Fig. 3: Relationship between snake length and venom yield.

Venom Yields: Figure 3 correlates venom yields with the total lengths of six snakes collected from the Alice Springs and Barkly Tableland districts.

Venom Toxicity: Dose and survival rates are presented in Table 1.

Table 1:

Dose (μg)	8	10	12.5	15.6	19.6	24.5	30.6
Survival Rates	4/4	4/4	4/4	4/4	3/4	0/4	0/4

The LD_{50} was calculated at $20.68 \mu\text{g}$. with the limits of confidence at $18.29 \mu\text{g}$. to $23.38 \mu\text{g}$.

There was no significant difference in results obtained from fresh venom and freeze-dried, reconstituted venom, or in the venom toxicities of snakes from the Barkly Tableland and Alice Springs districts.

Envenomation: A 4 kg cat was bitten on the upper lip by a snake measuring approximately 25 cm in total length. One hour after the bite the cat appeared distressed and slight hind limb paralysis was evident. The following conditions were recorded: vomiting; progressive respiratory paralysis; loss of eye preservation reflex; dilation of the pupils; uncontrolled urination; inability to stand; coma; death following terminal fits at approximately 4 hours after the bite.

Two adult rabbits were injected subcutaneously with venom doses of $1\frac{1}{2}$ and 2 times the calculated LD₅₀. Both rabbits appeared normal for an initial 35 minutes. The first sign of envenomation was dilation of the pupils which was rapidly followed by acute respiratory distress. Death occurred 45 minutes after the injection of venom.

Bite and injection sites were surrounded by local swelling and on sectioning clear oedema fluid was revealed. There was no evidence of haemolysis at the injection site. The lungs were oedematous in both the cat and the rabbits. Both the cat and the rabbits showed generalised mild perivascular oedema, swelling of the endothelial cells of blood vessels, and extensive alveolar oedema.

Discussion

Contrary to suggestions of hyperaggressiveness (Gow, loc. cit.), it is our experience in the Northern Territory that *Denisonia suta* will not attack unless provoked and will always attempt to escape even if it is closely pursued. However, it will bite savagely if it is handled and certainly if it is trodden underfoot it will nearly always bite while simultaneously struggling to free itself. The observations of McPhee, loc. cit. closely support our appraisal of *Denisonia suta* temperament.

When handled *D. suta* usually bites with the intention of delivering a prolonged 'chewing' bite rather than a momentary 'snap' bite. Several adult humans have suffered bites from this species while attempting to catch snakes in the Alice Springs town area. In all cases however the snake was quickly detached and it managed to deliver only a 'snap' bite. Reaction to the venom was mild, viz., local pain and substantial local swelling at the bite site which may radiate out to effect an entire limb.

In the Northern Territory the distribution of *Denisonia suta* generally coincides with areas of sparse human settlement (Fig. 2). One major town, Alice Springs (population of approximately 20,000), is encompassed by the distribution of this species but elsewhere human occupation is restricted to pastoral communities and Aboriginal settlements. In Alice Springs this species occurs throughout the residential town area and during summer many specimens are collected in and around houses at night.

In the southern Northern Territory its average adult length is much smaller than that of its counterpart 'Barkly' population. Using size and hence venom yield as the general criterion for assessing potential danger it is considered that in the 'Barkly' district snakes of average adult size and over are potentially dangerous to humans of all age groups while in the southern region snakes of maximum size constitute a danger to children. The maximum and average adult lengths of Victoria River district individuals are uncertain, however, those lengths given for the Barkly Tableland population are possibly also representative for snakes of this population.

Clinical and pathological evidence is consistent with the venom containing at least neurotoxins and cytolytins. There was no evidence of coagulants or haemolysins. These findings support the views of earlier workers:

Kellaway, loc. cit. records the reaction of a guinea pig, weighing 357 grams, after it was bitten by a *Denisonia suta* measuring 16½ inches in length.

"It... caused paralysis and death from failure of respiration in sixteen minutes... The venom evidently contains no thrombin... Its toxicity... depends upon its action on the motor nerve endings in the diaphragm."

"The venom is neurotoxic, without coagulants..." Worrell, loc. cit.

In conclusion we propose that although *Denisonia suta* is a proven threat to domestic small animal life, it poses only a minor hazard to humans in the Northern Territory.

Addendum

After this paper went to press, Dr. G. M. Storr of the Western Australian Museum, referred the Victoria River district specimens to a new taxon. *Denisonia* nov. sp. Populations in the Barkly Tableland and Alice Springs districts remain *D. suta* (Storr, pers. comm.).

Acknowledgements

We are especially grateful to S. K. Sutherland and W. A. Low for critically reading the manuscript and P. J. Gully for promptly reporting the snake-bite involving a domestic cat.

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FOOTNOTE:- The current committee would like to inform readers of the N.T. Naturalist of duplicity of publication of an article, entitled "Effects of a bite from a Barking Spider". by Geoffrey Robinson and Graham Griffin, which appeared in N.T. Naturalist No. 6. This article has also been published in "The Victorian Naturalist" Vol. 100 1983.

THE STATUS OF KINGFISHERS AND THEIR ALLIES (*Coraciiformes*) IN THE DARWIN AREA, N.T., 1974 TO 1982

H. A. F. Thompson

Introduction

This is the third of a series of papers summarising data on birds in the area of the Sanderson Sewage Ponds, Darwin. A number of observers have been involved in this.

For previous papers, see McKean (1981) and Thompson (1982).

Methods

This account covers the period from March 1974 to February 1982 and includes the destruction of Darwin and much of its natural landscape on the night of 24-25 December 1974. Our study of the area is still continuing.

Although this account, like the two before it, is simply a summary of casual observations, it is the only such body of information for the Darwin area. Each site was usually visited at least once a month; McKean has detailed these sites (*loc. cit.*).

The histograms show the total number of individual birds for each month, with the results for each month pooled. This means, for example, that a July figure is the total of all the July totals for the whole survey period. In the case of two species, there is an additional histogram giving the maximum number of individuals recorded in the month in any survey site, again with the monthly figures pooled for the whole survey period.

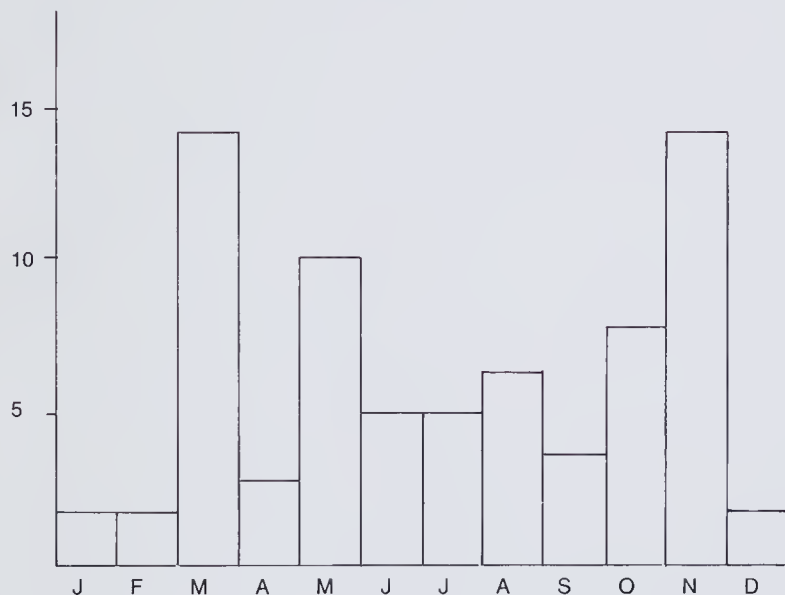
There are nine species involved; seven species of kingfisher (*Alcedinidae*) and one representative each of the bee-eaters (*Meropidae*) and rollers (*Coraciidae*). Together they constitute the three families of the order *Coraciiformes* in the N.T. In general, the species are easy to observe and identify and present fewer survey problems than other groups.

Azure Kingfisher *Ceyx azureus*

The Azure Kingfisher is a waterside species. In the Darwin area, it occurs along the edges of mangroves, along the tidal and non-tidal reaches of rivers and creeks and, sometimes near streams in rain-forests. It usually prefers well vegetated watercourses.

The uneven histogram is marked by two 'highs', caused by high counts in March and November 1974, 11 and 8 respectively. No other single monthly total exceeds 4. This suggests that whilst the species may never have been especially common in the study area, it became much scarcer after the 1974 cyclone.

The total number of individuals recorded for the ten months of 1974 is 28, a monthly average of 2.8. That of the next highest year, the twelve months of 1979, is 10, an average of 0.83. We have no records of the species in the study area in 1975, the year immediately after the cyclone. We recorded 9 individuals for both 1980 and 1981, an average of 0.75. Either the 1974 figures were atypically high or the species has not even yet fully recovered from the damage caused to its habitat by Cyclone Tracy.

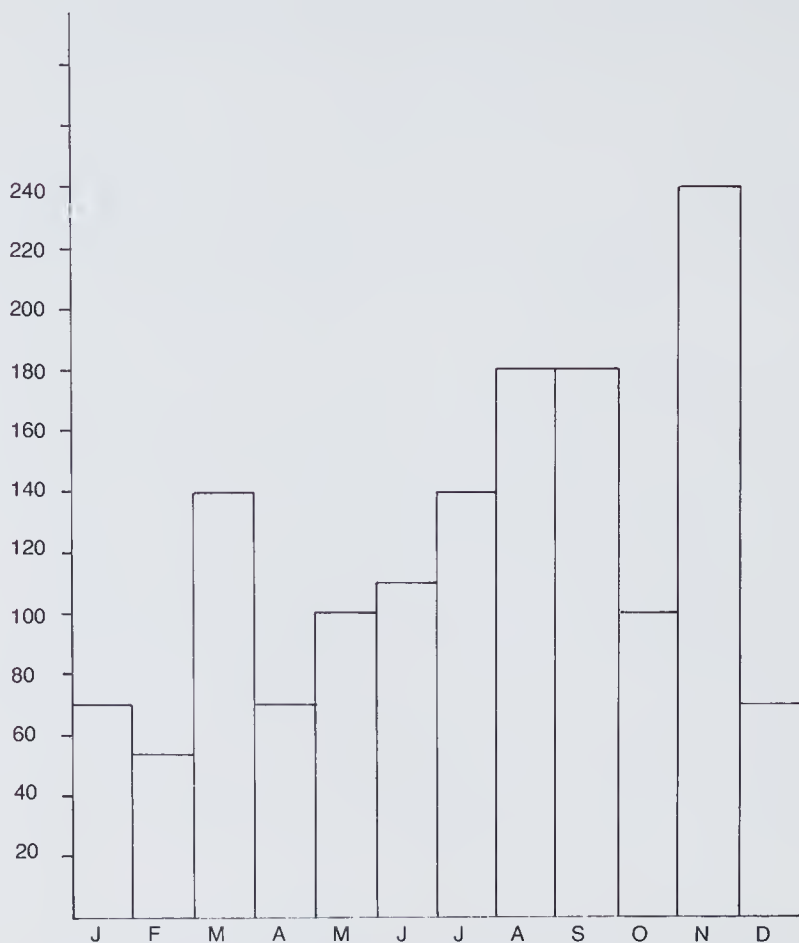


The species is quite common outside the immediate city area. John Estbergs has a record of a nest with eggs at Humpty Doo, 20 April 1974. Storr (1977) defines the breeding season as November to April.

Little Kingfisher *Ceyx pusillus*

The Little Kingfisher occupies a similar range of habitats to the Azure Kingfisher in the Top End of the Northern Territory. However, it is much less common; we have only six individual records from the study area for the survey period. There are two records each from July and December and one each from January to November.

Away from the immediate Darwin area, I have records from Fogg Dam and Beatrice Creek, a tributary of the Adelaide River. There are breeding records from Workshop Jungle near Fogg Dam (J. L. McKean, J. A. Estbergs, and A. L. Hertog, pers. comm.).



Blue-winged Kookaburra *Dacelo leachii*

The Blue-winged Kookaburra is a common species throughout much of the Top End, including suburban Darwin. It is largely an open forest bird, most often found in the eucalypt-dominated habitats but it also occurs in paperbark woodlands and on the fringes of mangroves and monsoon-forests.

Storr (loc. cit.) gives the breeding season as September to December. It is difficult to explain the peaks on the histogram. The species is noisy throughout the year and thus not particularly so in the breeding season when it might be more noticeable. As far as we know it does not migrate, a likely explanation for peaks with other species. It is reasonable to assume, though, that the low figures for January and February may indicate the moulting season when the birds are likely to be quieter than normal. This is likely to happen soon after the breeding season.

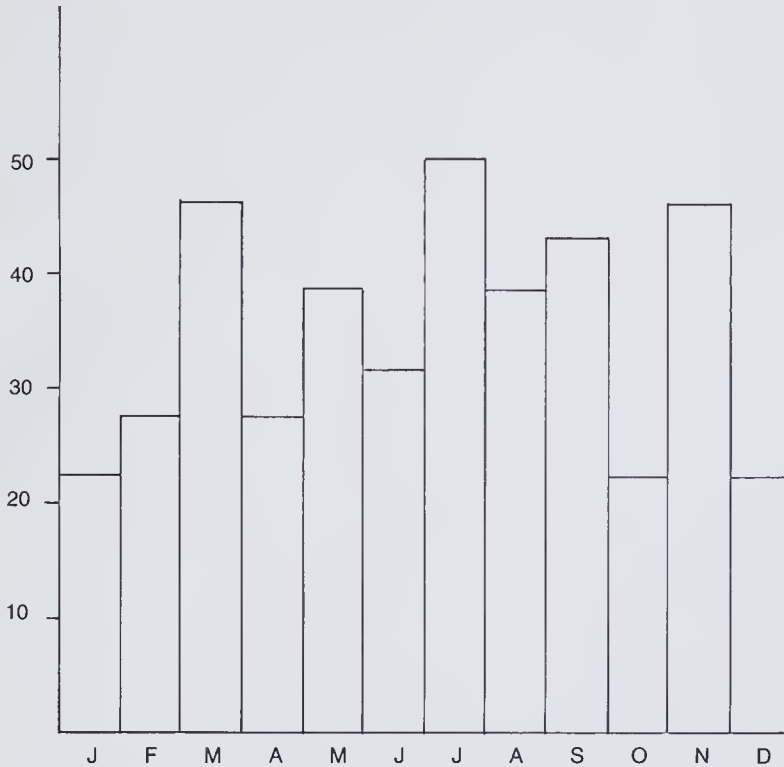
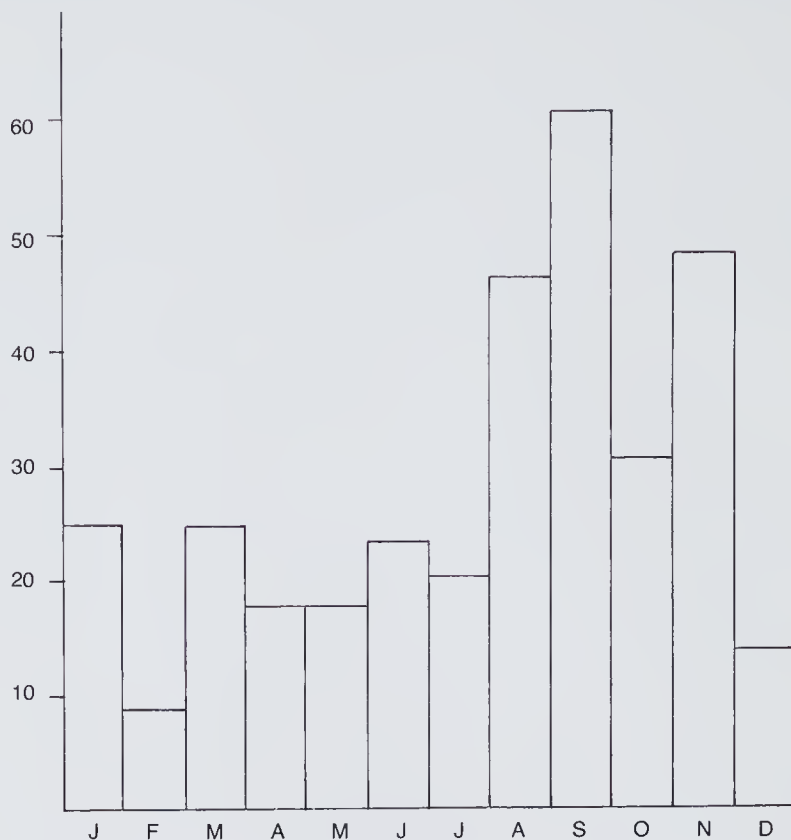


Fig. 3 plots the maximum number of individuals for each month. The pattern is similar to that of Fig. 2 except for the high July figure, caused by a maximum of 20 in July 1974. This is another pre-cyclone figure that has never been matched since. Apart from this, there is nothing in the data to suggest that Fig. 2 has been disrupted by unusually high maximum counts which have pushed up the total number of individuals for the month. The high November peak in Fig. 2 is again supported by an abnormally high 1974 total when 88 individuals were recorded.

Forest Kingfisher *Halcyon macleayii*

The Forest Kingfisher is another common species in much of the Top End. Although it is found close to Darwin's suburbs, for example in our study area, it seems to be less tolerant of man than either the Blue-winged Kookaburra or the Sacred Kingfisher. Whilst it occurs in eucalypt woodland and on the fringes of monsoon forest, it prefers habitats close to fresh water, especially paperbark woodland. In general, it avoids mangroves and suburban gardens.

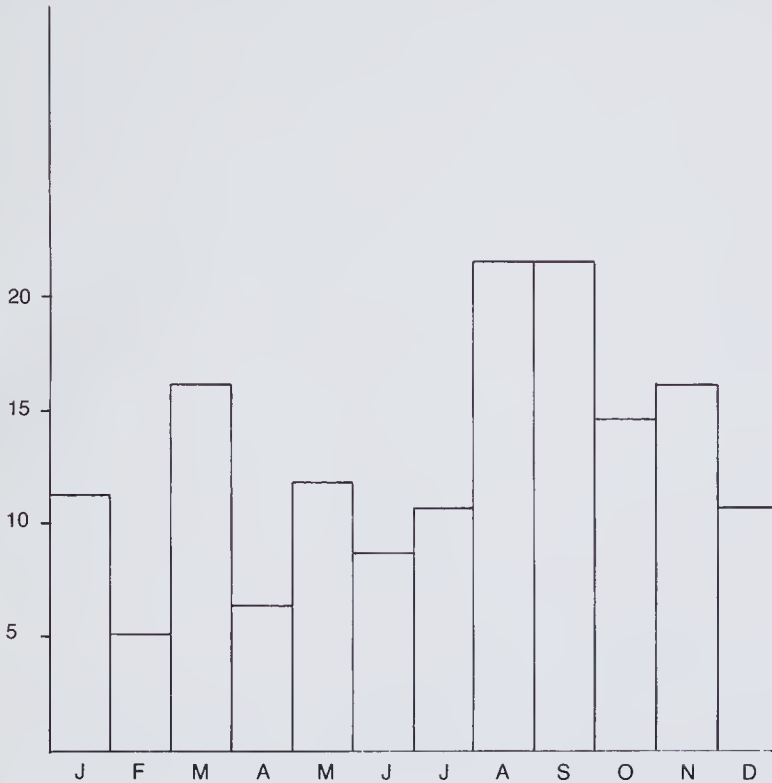
The species is widespread to the east of Darwin where there is suitable habitat but it does not seem to penetrate as far inland as some northern species. Storr (loc. cit.) records its range south to Port Keats, Fountain Head, El Sherana and Port



Bradshaw. I have a record of a single bird on the Delamere Road, Willeroo station on 19-20 August 1972, at 15°17'S, 131°35'E. This is well to the south of Storr's limits.

Storr gives the breeding season as September to November. Our records generally agree with this. As a nest-site, it favours the nests of those termites which build their colonies in trees. The birds excavate a cavity in these globular structures. We have a record from the study area of a pair excavating on 21 and 29 October 1978; the sitting bird was put off the nest on 11 November. Breeding records from outside the study area fit into Storr's limits with one exception, a record of a pair excavating in the Kapalga area on 22 May 1981 (J. L. McKean and A. L. Hertog).

The two histograms, Figs. 4 and 5, have similarities. Fig. 4 records total numbers of individuals, Fig. 5 the maxima for any survey site. Both show relatively low dry season figures, that is from April to August, with a peak at the end of the dry season which tails off with the onset of the wet. This probably coincides with the period during which the birds are establishing their territories and are at their noisiest.

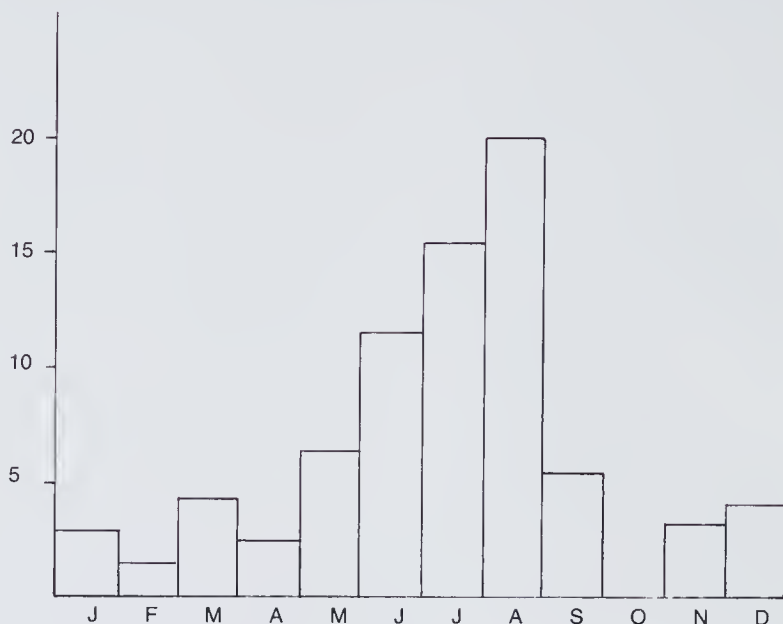


The relatively low figures for December, January and February suggest a quiescent phase after the breeding season. There is no evidence that the local birds migrate; they belong to the nominate race. However, the race in south-eastern Australia, *H.m. incincta*, is migratory, breeding in Australia and wintering in the Kai Islands, eastern Papua New Guinea and New Britain (Condon: loc. cit.). There are no records of this form from the Territory.

Red-backed Kingfisher *Halcyon pyrrhopygia*

This is the kingfisher of the arid interior, quite common around Alice Springs throughout the year. In Darwin, it is largely a dry season visitor, generally moving away from the area to breed. In the survey area, it is usually found in eucalypt woodland. Elsewhere in Darwin, it may frequent open areas with few trees where it often perches on power-lines. It sometimes ventures into suburban streets.

Like many arid zone species, the Red-backed Kingfisher population fluctuates and birds may breed outside their normal range. I know of only one breeding record from the Darwin area. On 19 November 1973, C. R. Fenner was given two well-grown fledglings that had been found in the Coonawarra area. Storr (loc. cit.) records breeding north to Marrakai.



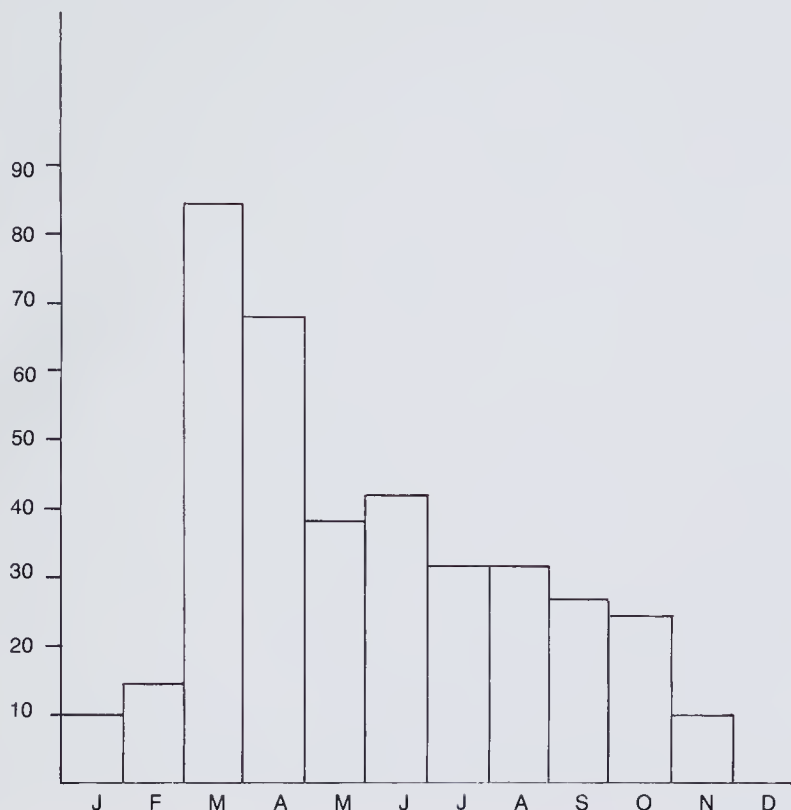
Sacred Kingfisher *Halcyon sancta*

Condon (loc. cit.) states that the southern populations of this species are migratory and that it winters in northern Australia, Papua New Guinea and the southern Philippines. Mason and Schodde (in Reader's Digest, 1976) suggest that the seasonal movements are only clear-cut in the southern part of the bird's Australian range.

Sacred Kingfishers are present in the study area virtually throughout the year but, as the histogram shows, we have no records for December and the figures for November, January and February are low. The March peak suggests a heavy passage migration through the area, tailing off towards the end of the year. The June figure is perhaps anomalous: the 1974 figure is once again high at 26, over five times the next highest June figure. Interestingly, there seems to be no return, presumably southbound passage through the area. This must follow another route so that in this respect, the species resembles the Little Curlew *Numenius minutus* in which the northbound passage usually by-passes Darwin (Thompson, 1978).

We do not know whether the Sacred Kingfisher breeds regularly in the Darwin area. Storr describes it as breeding north to Katherine in December and January, the season when Darwin populations are at their lowest. However, there are breeding records from the Top End. W. R. Mason found a nest with four eggs east of Humpty Doo on 29 October 1978. J. and L. Short found a nest with young near Kapalga on 12 December 1979 (per J. L. McKean).

The Sacred Kingfisher occupies a wider range of habitats than most species of *Halcyon* in the Darwin area. It occurs in most lightly timbered situations, including suburban gardens, but generally avoids the more closed forests, such as monsoon forest, except on the fringes. It does frequent mangroves, often close to the Collared Kingfisher but favours the landward side of the succession.

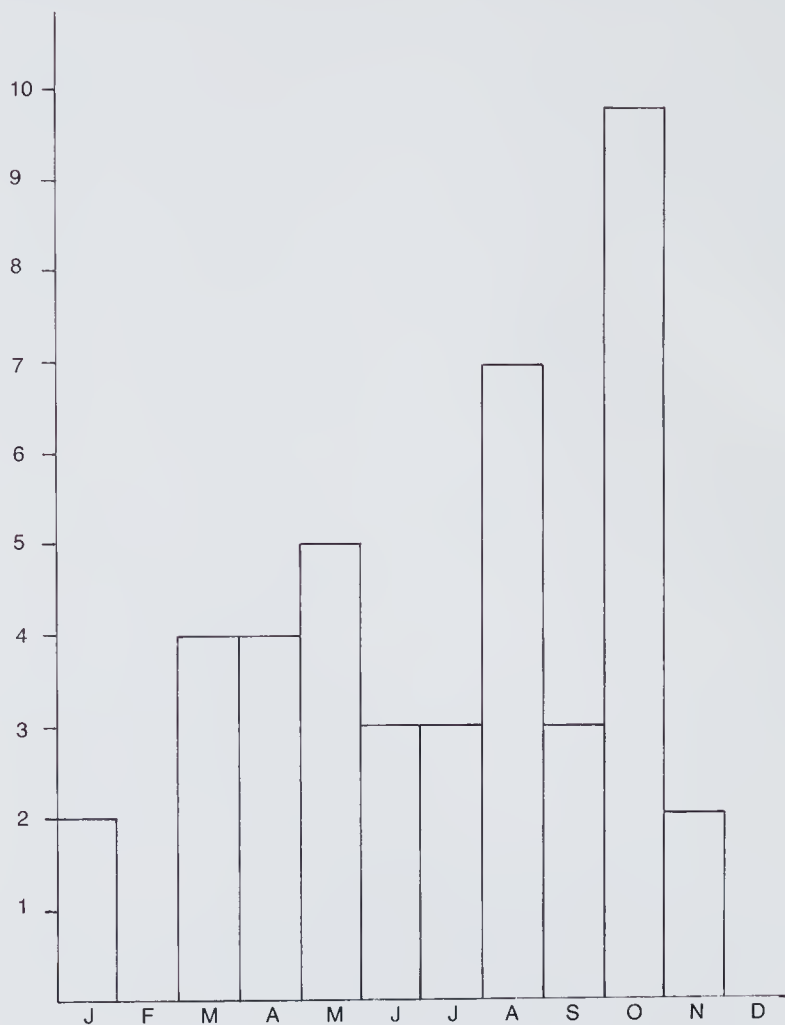


Collared (Mangrove) Kingfisher *Halcyon chloris*

It is difficult to explain the uneven nature of the histogram for the Collared Kingfisher, except through insufficient data. Whilst the species is quite common in suitable habitats in the Darwin area, being regular at Nightcliff, Dynah Beach and Ludmilla Creek and other sites, it is fairly scarce in the study area. In this case, the high October figure is not caused by a high 1974 count; the scanty data we do have gives consistent readings for the month.

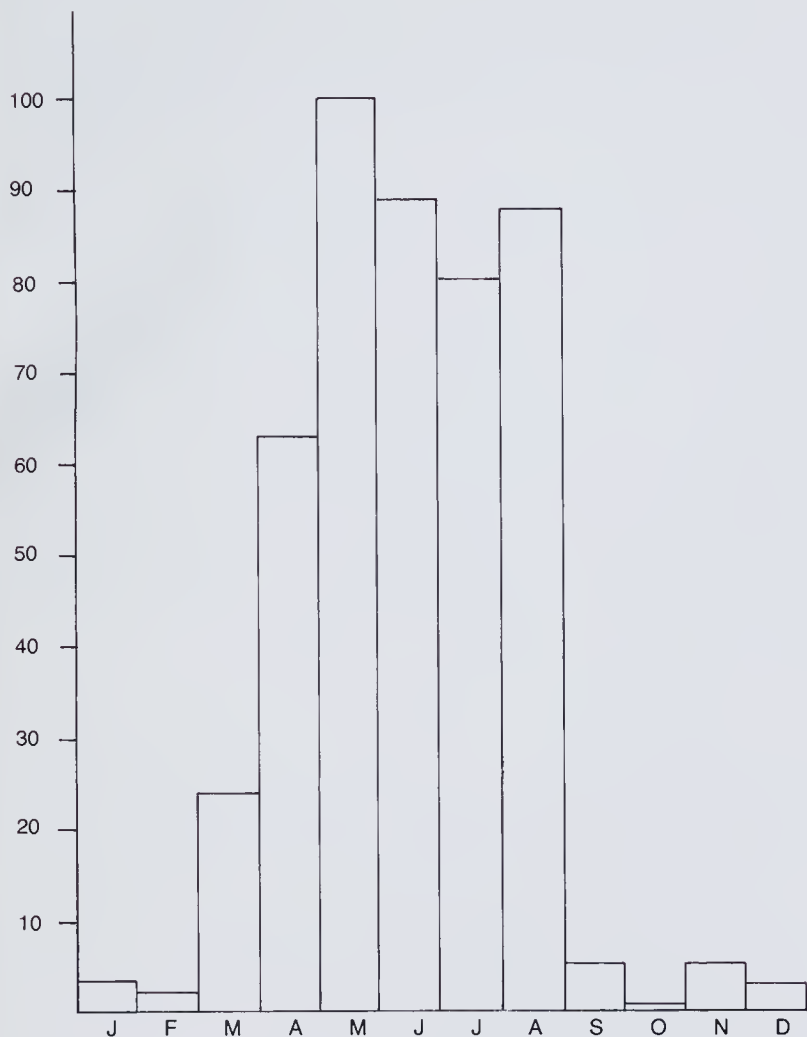
Condon describes the species as migratory in Australia. Storr does not comment on this aspect of its behaviour whilst mentioning an undated breeding record from Melville Island. Our records show that it is present virtually throughout the year.

In the Darwin area, the bird is restricted to mangroves, as its alternative name, 'Mangrove Kingfisher' suggests. However, in South-east Asia, including Timor, some 500 kilometres to the north, it is much more catholic in its choice of habitat, frequenting village gardens. In the Malay Peninsula, it is quite common in coastal she-oaks *Casuarina equisetifolia* but it avoids them in the Darwin area. There is one record of the bird 'out of habitat' in the study area, in monsoon forest 300 metres from mangroves (J. L. McKean).



Birds of the Australian race, *H.c. sordida* are much darker and less blue on the upperparts than the races in South-east Asia.

The Collared Kingfisher breeds in the last quarter of the year in the Darwin area. On 22 October 1977, I saw a pair apparently prospecting for nest-sites at Nightcliff and by 7 November, one was feeding the other on the nest. Its choice of habitat in the Darwin area may well be governed by the presence of large, decaying mangroves with suitable nest-holes.



Rainbow Bee-eater *Merops ornatus*

Condon describes this species as breeding in temperate and tropical Australia, migrating in winter to the Lesser Sundas, the lowlands of Papua New Guinea, the Bismarck Archipelago and the Solomon Islands. He points out that it is commoner in the north and east of the country than in the cooler, more southern districts.

Storr describes its range as the greater part of the Territory and notes that it is very common in the northern sub-humid zone from April to August, noting further that it breeds north to Darwin from September to December.

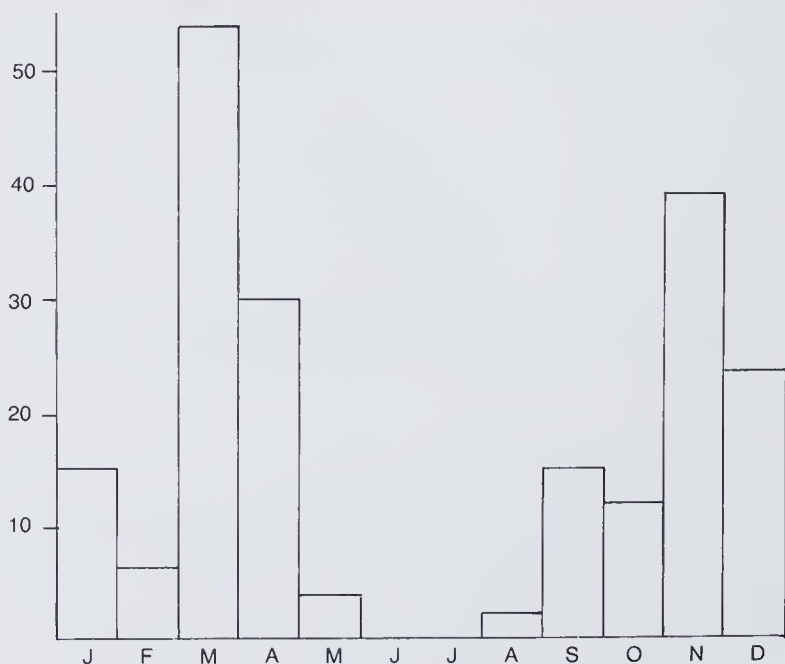
Fig. 9 shows a striking increase in the numbers of Rainbow Bee-eaters, beginning in March and reaching a peak in May, after which, it levels off to decline sharply at the end of August. There is a small population present throughout the year. During the dry season, it is a common and familiar bird in the Darwin area, including the suburbs where it may roost in quite large numbers, for example, about 200 birds at Rapid Creek (30 May 1976).

It breeds in the Top End in small numbers. J. L. McKean and myself found a bird excavating a nest-burrow near Red Lily Billabong, Kapalga, on 9 October and I found a pair with well-grown young at Ludmilla Creek, Darwin, in late October and early November, 1980. I found several birds on South Goulburn Island, north-east of Darwin between 18 and 20 February 1981, including a pair with well-grown young (Thompson, 1983, in press).

The data suggests that Darwin receives a substantial wintering population from some part or parts of southern Australia. Serventy and Whittell (1967 and later edition) state that the species is a strict migrant to the southern part of Western Australia but present throughout the year from the Gascoyne and Upper Murchison rivers north to the Kimberleys. There may be 'leap-frog' migration, with birds from the extreme south migrating north over the populations in 'the middle'.

Morris, McGill and Holmes (1981) describe it as a partial migrant in New South Wales, least numerous on the South Coast and present in all months on the Northern Rivers.

The May peak on the histogram suggests that Darwin hosts Rainbow Bee-eaters on passage to winter quarters further north. J. L. McKean, I. J. Mason and myself found the species widespread in many parts of East Timor in May 1974.



Dollarbird *Eurystomus orientalis*

The Dollarbird is a migrant in the Australian part of its range, breeding in the north and east of the country and wintering in parts of Indonesia and Papua New Guinea (Condon). Storr describes it as a common visitor to the northern third of the Northern Territory, arriving in September-November and leaving in March-May. It breeds from October to December.

The histogram shows no records for June and July and few for May and August: the species is largely absent from the Darwin area for these four months. The peaks in March/April and November/December, over and above the steady wet season population, suggest that there may be a passage of birds through Darwin. If this is the case, then it is a two-way passage in the case of the Dollarbird, unlike that of the Sacred Kingfisher or the Rainbow Bee-eater. The birds appear to be passing through the Darwin area at the end of the year, presumably to breeding areas elsewhere in Australia and then returning to their winter quarters in islands to the north in March and April.

'High peaks' on the histogram for March and November are only partly caused by high 1974 figures and are borne out by the figures for the following years.

Acknowledgements

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J. L. McKean read the draft of this paper, allowed me to use his personal notes and helped with the references.

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